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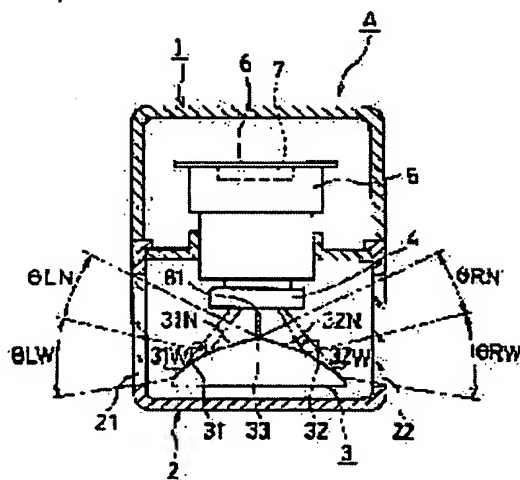
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(54) ON-VEHICLE MULTI-DIRECTIONAL IMAGE PICKUP CAMERA

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an on-vehicle multi-directional image pickup camera by which a dead angle of a photographing range is reduced by forming a reflecting face of a mirror with pluralities of faces.

SOLUTION: The side shape of a mirror 3 is formed nearly triangle. A mirror surface is formed by applying aluminum vapor-deposition to a couple of left/ right reflecting faces 31, 32 of a molding made of a synthetic resin. A ridge 33 is in existence on a border between the reflecting faces 31, 32. The reflecting faces 31, 32 at both sides of the ridge form respectively flat parts 31N, 32N and the remaining parts are curved parts 31W, 32W. Thus, a range to the left of the flat part 31N of the reflecting face 31 plays reflection in a normal state, and a range denoted by an angle θ_{LW} of the flat part 31W causes reflection in a wide angle state. Similarly, a range to the right of the flat part 32N of the reflecting face 32 plays reflection in a normal state, and a range denoted by an angle θ_{RW} of the flat part 32W causes reflection in a wide angle state. Thus, in the case of photographing a scene at the outside of the vehicle, a dead angle of the photographing range is reduced.



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CLAIMS

[Claim(s)]

[Claim 1] A mirror (3) with two or more reflectors (31 32) is arranged in the front face of a lens (4). In the multi-direction image pick-up camera equipment for mount which receives the beam of light from two or more directions of [outside the vehicle reflected by this mirror (3)] with a lens (4), and was made to carry out image formation to an image sensor (7) The multi-direction image pick-up camera equipment for mount characterized by forming the reflector (31 32) of said mirror (3) in two steps of surface parts (31N, 32N, 31W, 32W), respectively.

[Claim 2] The multi-direction image pick-up camera equipment for mount characterized by having formed the flat-surface section (31N, 32N) in a part of reflector (31 32) of said mirror (3), and forming the curved-surface section (31W, 32W) in the remainder, respectively in said invention according to claim 1.

[Claim 3] In said invention according to claim 1 or 2, while said mirror (3) has the reflector (31 32) of a Uichi Hidari pair The multi-direction image pick-up camera equipment for mount characterized by having arranged the ridgeline section (33) on the boundary of the reflector (31 32) of this pair in the front face of a lens (4), and having formed the flat-surface section (31N, 32N) in the both sides of this ridgeline section (33), and forming the curved-surface section (31W, 32W) in the remainder, respectively.

[Claim 4] The multi-direction image pick-up camera equipment for mount characterized by turning and setting up the light-receiving direction of said lens (4) behind a car while equipping with the case (1) which contained said image sensor (7) at the tip of a car in said invention according to claim 3.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to amelioration of the multi-direction image pick-up camera equipment for mount which can picturize the many directions at once especially with one camera about the multi-direction image pick-up camera equipment for mount which picturizes the many directions, such as a longitudinal direction for example, outside a vehicle.

[0002]

[Description of the Prior Art] For example, when making a car advance into a crossing etc., irrespective of the existence of a signal, existence of the other car is recognized and a safety check is needed. However, when that was the bad location of a prospect, it was difficult to see a road situation on either side. Then, it came, whenever it was shown in JP,1-109447,U in view of such [conventionally] a trouble, and the side supervisory equipment for cars which picturizes with the camera which established the road situation on either side ahead of the car, and performs a safety check was proposed. This side supervisory equipment for cars was the structure equipped with the image pick-up camera and the reflective mirror arranged in that front face.

[0003]

[Problem(s) to be Solved by the Invention] However, in the case of the above-mentioned conventional technique, the reflector of a reflective mirror was a plane, and since the image pick-up range with an image pick-up camera was narrow, the problem that a dead angle increased had occurred. This invention solves the above-mentioned trouble and aims at offering the multi-direction image pick-up camera equipment for mount which lessened the dead angle of the image pick-up range.

[0004]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, first invention according to claim 1 In the multi-direction image pick-up camera equipment for mount which arranges a mirror with two or more reflectors in the front face of a lens, receives with a lens the beam of light from two or more directions of [outside the vehicle reflected by this mirror], and was made to carry out image formation to an image sensor The multi-direction image pick-up camera equipment for mount characterized by forming the reflector of said mirror in two steps of surface parts, respectively is offered.

[0005] Moreover, invention according to claim 2 offers the multi-direction image pick-up camera equipment for mount characterized by having formed the flat-surface section in a part of reflector of said mirror, and forming the curved-surface section in the remainder, respectively.

[0006] Moreover, invention according to claim 3 offers the multi-direction image pick-up camera equipment for mount characterized by having arranged the ridgeline section on the boundary of the reflector of this pair in the front face of a lens, and having formed the flat-surface section in the both sides of this ridgeline section, and forming the curved-surface section in the remainder, respectively while said mirror has the reflector of a Uichi Hidari pair.

[0007] Moreover, invention according to claim 4 offers the multi-direction image pick-up camera equipment for mount characterized by turning and setting up the light-receiving direction of said lens behind a car while equipping with the case which contained said image sensor at the tip of a car.

[0008]

[Embodiment of the Invention] The gestalt of operation concerning this invention is explained based on an attached drawing. one in a drawing -- a case and 2 -- covering and 3 -- a mirror and 4 -- a lens and 5 -- lens mount and 6 -- a substrate and 7 -- an image sensor and 8 -- for packing, and 11 and 12, as for a filter and 14, a rubber vibration insulator and 13 are [a mirror holder and 9 / a stationary plate and 10 / a spacer and 15] sub substrates. Hereafter, each [these] configuration is explained.

[0009] First, a case 1 is fabricated by the member of non-translucency, combines covering 2, and forms a predetermined housing. The plane of composition of this case 1 and covering 2 is equipped with packing 10, and watertight construction is formed.

[0010] Moreover, other parts excluding [covering 2] the apertures 21 and 22 on either side have non-translucency. For example, after carrying out insert molding of the apertures 21 and 22 of the right and left fabricated with transparence acrylic resin to the member of non-translucency, and forming them or fabricating covering 2 with transparence acrylic resin, it forms using the proper means of performing and forming black paint in other parts except the apertures 21 and 22 on either side.

[0011] Moreover, after a side-face configuration constitutes the shape of an abbreviation triangle and fabricates a mirror 3 with synthetic resin, it gives aluminum vacuum evaporations to the reflectors 31 and 32 of a Uichi Hidari pair, and forms a mirror plane in them. The ridgeline section 33 exists in these two reflectors 31 and the boundary between 32. Each reflectors 31 and 32 form the flat-surface sections 31N and 32N in the both sides of the ridgeline section 33, respectively, and form the curved-surface sections 31W and 32W in the remainder. This changes with the range of the left of the car B shown in drawing 1 and drawing 4 by include-angle thetaLN being reflected in an ordinary condition, and the range shown by include-angle thetaLW being reflected in the state of a wide angle in the curved-surface section 31W remaining in 31Ns of flat-surface sections of the left-hand side reflector 31. Similarly, in 32Ns of flat-surface sections of the right-hand side reflector 32, it changes with the range which the range of the right shown by include-angle thetaRN is reflected in the ordinary condition, and is shown by include-angle thetaRW in the curved-surface section 32W remaining being reflected in the state of a wide angle.

[0012] Moreover, a lens 4 condenses the beam of light reflected in each reflectors 31 and 32 of the above-mentioned mirror 3, and has set it as the front face of the image sensor 7 which mentions the focus later. It equips with this lens 4 using lens mount 5 to the substrate 6 which laid the image sensor 7. In addition, the filter 13 for intercepting the light of wavelength other than a visible ray and the spacer 14 are formed in the lens mount 5 interior. In the front face of this lens 4, the ridgeline section 33 of the above-mentioned mirror 3 is arranged.

[0013] Moreover, the substrate 6 has equipped with the sub substrate 15 and terminal 61 other than lens mount 5 which supported the

above-mentioned lens 4, and constitutes them possible [connection] electrically with AV (Audio Visual) equipment (not shown) of the vehicle interior of a room by the terminal 61 inserted in hole 1a of a case 1. It has equipped with rubber vibration insulators 11 and 12 between this substrate 6 and covering 2, and the substrate 6 is supported elastically.

[0014] Moreover, an image sensor 7 is a component for changing into an electric image pick-up signal the light which carried out image formation to the front face of this component, for example, the CCD (Charge Coupled Device) component is used for it.

[0015] Moreover, the mirror holder 8 consists of the member of non-translucency, and forms the dashboard 81 in one. a dashboard 81 -- between two reflectors 31 and 32 -- optical -- intercepting -- a beam of light -- surroundings **** -- it is a configuration for preventing things and has prepared between the ridgeline section 33 of a mirror 3, and a lens 4. Therefore, it reflects only in the left-hand side reflector 31, and the beam of light which carried out incidence from the left-hand side aperture 21 does not have surroundings **** in the right-hand side reflector 32. It reflects only in the right-hand side reflector 32, and the beam of light which carried out incidence from the right-hand side aperture 22 similarly does not have surroundings **** in the left-hand side reflector 31.

[0016] Thus, the constituted multi-direction image pick-up camera equipment A for mount turned and set up the light-receiving direction of a lens 4 behind Car B, and the reflector 31 of said left-hand side is turned leftward [of Car B], and it has turned the right-hand side reflector 32 rightward, respectively while attaching near the tip of Car B, for example, the front-bumper section. Thus, when the light-receiving direction of a lens 4 is turned and set up behind Car B, the image displayed on the image and AV equipment which carry out image formation to the front face of an image sensor 7 changes with the image which does not carry out right-and-left reversal, i.e., an image [having seen visually], so that it may illustrate to drawing 3, and visibility is excellent. And since it is reflected in the condition ordinary in the flat-surface sections 31N and 32N of a reflector 31 and is reflected in the state of a wide angle in the remaining curved-surface sections 31W and 32W, the picturized image grows into the left image a shown in drawing 3 with Notations LN and RN, and an image with the ordinary central range near the boundary line c of the right image b, and the both-ends range shown with Notations LW and RW changes with the image of a wide angle. Therefore, compared with the case where a reflector 31 and the 32 whole are flat surfaces, the dead angle of the image pick-up range can be lessened.

[0017] Here, the formula for designing the radius of curvature R of curved-surface section 32W of one reflector 32 is explained using drawing 5. As for the height dimension of a mirror 3, and Notation L, the notation R in drawing 5 shows the base dimension of one side of a mirror 3 for the radius of curvature of curved-surface section 32W, and Notation T, as for the distance from the ridgeline section 33 of a mirror 3 to the focus of a lens 4, and Notation W. moreover, the include angle (the back viewing angle) and the notation theta 3 which extended in the location (notation C' shows the normal at this time) shown by notation D' from the location (a notation C shows the normal at this time) where a notation theta 0 is shown in drawing 5, and, as for a notation theta 1, a notation theta 2 shows a visual field limitation with Notation D whenever [setting angle / of a mirror 3] at an angle of one half of the field angles of a lens 4 -- one mirror plane of a mirror 3 -- a central angle is shown.

[0018] When it asks for the formula which searches for the radius of curvature R of curved-surface section 32W, it consists of the relation of the above-mentioned notations R, T, L, W, theta0, theta1, theta2, and theta3 as follows. The relation between the base dimension W, distance L and the height dimension T, and an include angle theta 0 is $W=(L+T) \tan \theta_0$ first..... It is a formula (1). It changes. Moreover, the relation between an include angle theta 1, the height dimension T, and the base dimension W is $\theta_1=\tan^{-1}(T/W)$ It is a formula (2).

It changes. Although the line shown in drawing 5 with Notation E is a bisector of an include angle theta 3, this bisector E exists by said Normal C and parallel (E//C).

[0019] the visual field limitation of a reflector 32 -- an include angle theta -- the normal C shown in drawing 5 when extending about two -- again -- an include angle theta -- it inclines about two and changes with normal C'. As described above, it is parallel to the bisector E of an include angle theta 3, and this normal C is $\theta_2=\theta_3/2$ It is a formula (3).

***** is materialized.

[0020] Moreover, relation between the base dimension W, radius of curvature R, an include angle theta 3, and an include angle theta 1 $W=2Rx\sin(\theta_3/2) \times \cos \theta_1 = 2Rx\sin \theta_2 \times \cos \theta_1$ Formula (4)

Come out, and it is and is from this type (4). $R=W/(2x\sin \theta_2 \times \cos \theta_1)$ Formula (5)

****. If it follows and said formula (1) and (2) are substituted for this type (5) $R= \{(L+T) \tan \theta_0\} / <2x\sin \theta_2 \times \cos [\tan^{-1}\{T/(L+T) \tan \theta_0\}]\}$ Formula (6)

It changes. Radius of curvature R is calculable with this formula (6).

[0021]

[Effect of the Invention] In the multi-direction image pick-up camera equipment for mount which invention according to claim 1 arranges a mirror with two or more reflectors in the front face of a lens, receives with a lens the beam of light from two or more directions of [outside the vehicle reflected by this mirror], and was made to carry out image formation to an image sensor Since it is the multi-direction image pick-up camera equipment for mount characterized by forming the reflector of said mirror in two steps of surface parts, respectively, when the situation outside a vehicle is picturized, the dead angle of the image pick-up range changes few, and there is effectiveness that a safety check degree improves.

[0022] Moreover, since invention according to claim 2 is the multi-direction image pick-up camera equipment for mount characterized by having formed the flat-surface section in a part of reflector of said mirror, and forming the curved-surface section in the remainder, respectively, in addition to said effectiveness, it has the effectiveness which can usually be checked with both an image and a wide angle image that there is no distortion by the situation outside a vehicle picturized with the image sensor.

[0023] Moreover, while said mirror has the reflector of a Uichi Hidari pair, invention according to claim 3 Since it is the multi-direction image pick-up camera equipment for mount characterized by having arranged the ridgeline section on the boundary of the reflector of this pair in the front face of a lens, and having formed the flat-surface section in the both sides of this ridgeline section, and forming the curved-surface section in the remainder, respectively said effectiveness -- in addition -- for example, since it is easy to grasp distance with the other car since [which does not have distortion by the central site of the road where check significance is high] it can usually check with an image, and a road-shoulder side can check with a wide angle image, there is effectiveness that the two-wheel barrow which runs a road-shoulder side can be grasped.

[0024] Moreover, while invention according to claim 4 equips with the case which contained said image sensor at the tip of a car Since it is the multi-direction image pick-up camera equipment for mount characterized by turning and setting up the light-receiving direction of said lens behind a car In addition to said effectiveness, the image displayed on the image and AV equipment which carry out image formation on the surface of an image sensor changes with the image which does not carry out right-and-left reversal, i.e., an image [having seen visually], and there is effectiveness that visibility is excellent.

[Translation done.]

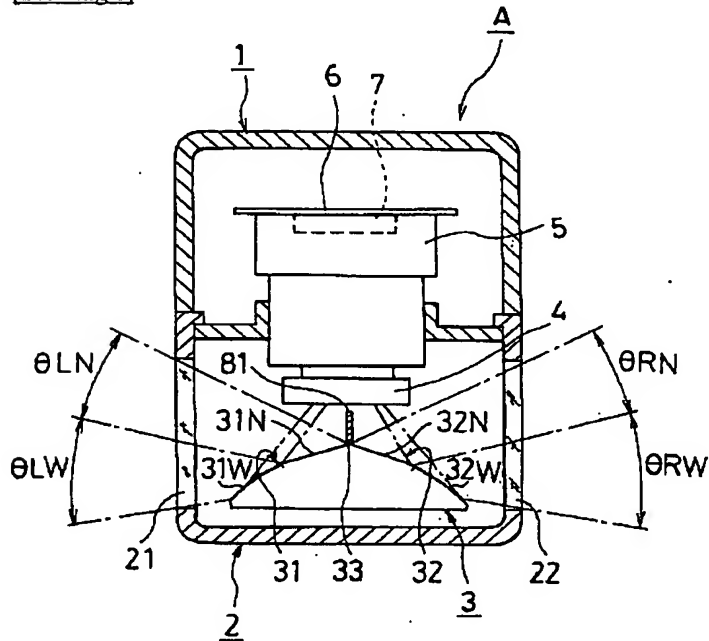
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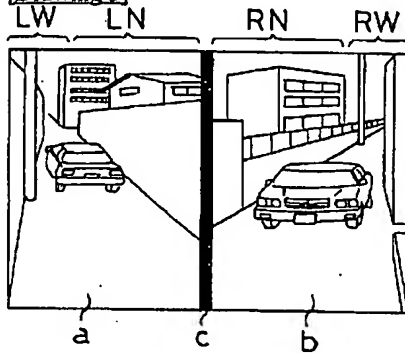
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DRAWINGS

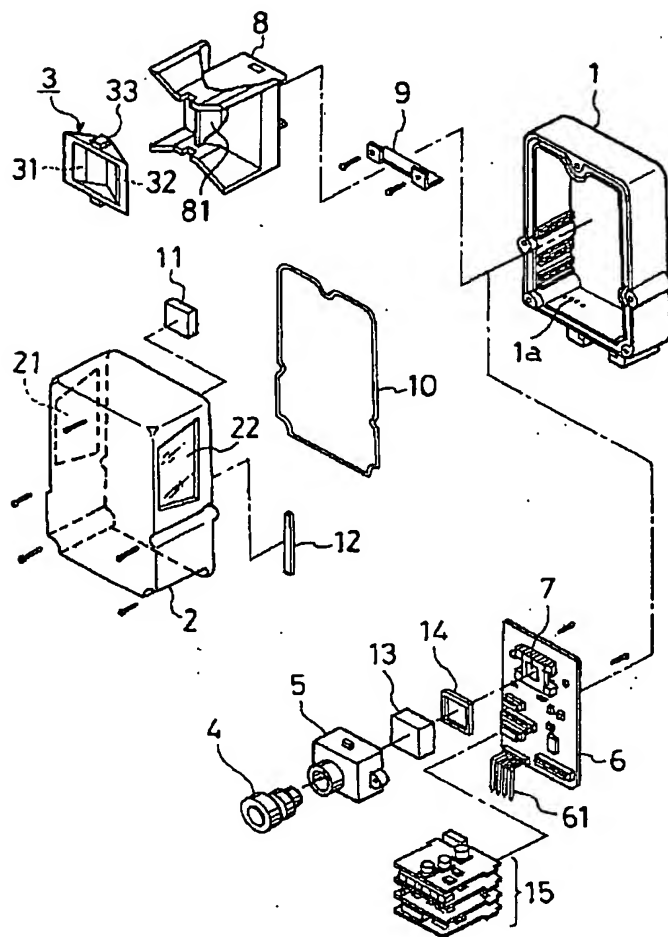
[Drawing 1]



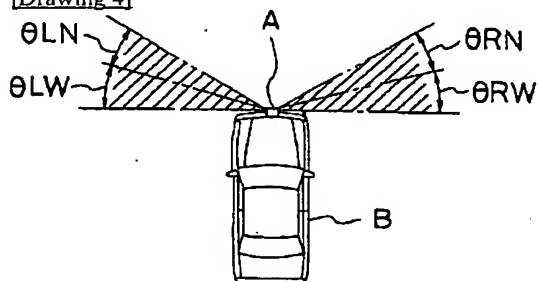
[Drawing 3]



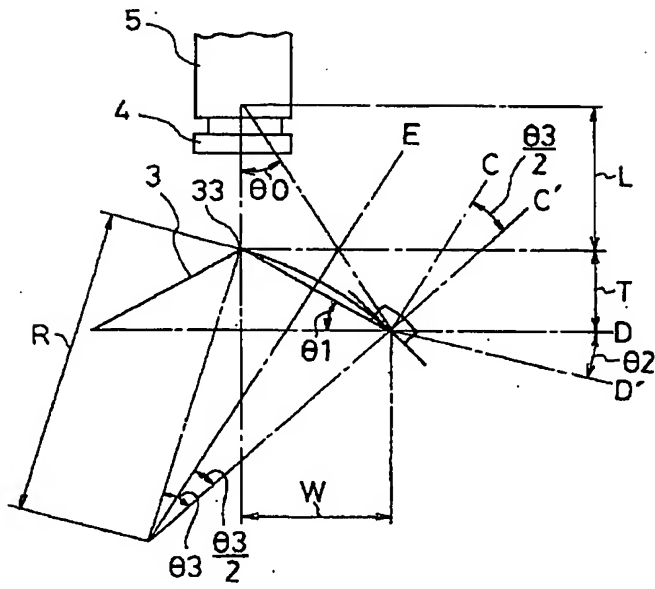
[Drawing 2]



[Drawing 4]



[Drawing 5]



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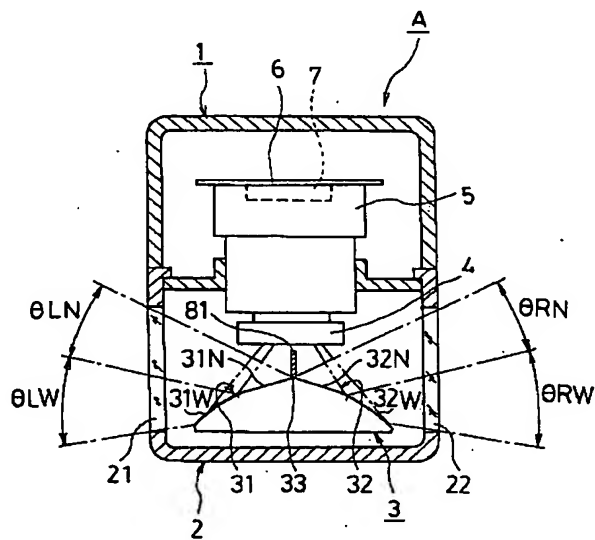
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(54) 【発明の名称】 車載用多方向撮像カメラ装置

(57) 【要約】

【課題】 撮像範囲の死角を少なくした車載用多方向撮像カメラ装置を提供する。

【解決手段】反射面 3 1、3 2 の稜線部 3 3 が有る中央側に平面部 3 1 N、3 2 N を形成し、両端側に曲面部 3 1 W、3 2 W を形成する。



【特許請求の範囲】

【請求項 1】 複数の反射面（3 1，3 2）を有したミラー（3）をレンズ（4）の前面に配置し、このミラー（3）で反射した車外の複数の方向からの光線をレンズ（4）で受光して撮像素子（7）に結像させるようにした車載用多方向撮像カメラ装置において、前記ミラー（3）の反射面（3 1，3 2）をそれぞれ 2 段の面部（3 1 N，3 2 N，3 1 W，3 2 W）で形成したことを特徴とする車載用多方向撮像カメラ装置。

【請求項 2】 前記請求項 1 記載の発明において、前記ミラー（3）の反射面（3 1，3 2）の一部に平面部（3 1 N，3 2 N）を、残部に曲面部（3 1 W，3 2 W）をそれぞれ形成したことを特徴とする車載用多方向撮像カメラ装置。

【請求項 3】 前記請求項 1 又は 2 記載の発明において、前記ミラー（3）が左右一對の反射面（3 1，3 2）を有するとともに、該一對の反射面（3 1，3 2）の境界にある稜線部（3 3）をレンズ（4）の前面に配置し、かつ該稜線部（3 3）の両側に平面部（3 1 N，3 2 N）を、残部に曲面部（3 1 W，3 2 W）をそれぞれ形成したことを特徴とする車載用多方向撮像カメラ装置。

【請求項 4】 前記請求項 3 記載の発明において、前記撮像素子（7）を収納したケース（1）を車両の先端に装着するとともに、前記レンズ（4）の受光方向を車両の後方に向けて設定したことを特徴とする車載用多方向撮像カメラ装置。

【発明の詳細な説明】

【0 0 0 1】

【発明の属する技術分野】この発明は、例えば車外の左右方向等の多方向を撮像する車載用多方向撮像カメラ装置に関し、特に 1 つのカメラによって多方向を一度に撮像することができる車載用多方向撮像カメラ装置の改良に関するものである。

【0 0 0 2】

【従来の技術】例えば、交差点等に車両を進入させる場合、信号機の有無に拘わらず他車両の存在を認識して安全確認を必要とする。ところが、そこが見通しの悪い場所である場合、例えば左右の道路状況を見ることが困難であった。そこで、従来このような問題点に鑑みて例えば実開平 1 - 1 0 9 4 4 7 号公報に示すごとく、左右の道路状況を車両の前方に設けたカメラで撮像して安全確認を行う車両用側方監視装置が提案されていた。この車両用側方監視装置は、撮像カメラとその前面に配置した反射ミラーとを備えた構造であった。

【0 0 0 3】

【発明が解決しようとする課題】しかしながら上記した従来技術の場合、反射ミラーの反射面が平面状であり、撮像カメラによる撮像範囲が狭いために死角が多くなるといった問題が発生していた。この発明は、上記した問

題点を解決するものであり、撮像範囲の死角を少なくした車載用多方向撮像カメラ装置を提供することを目的としたものである。

【0 0 0 4】

【課題を解決するための手段】上記課題を解決するために、まず請求項 1 記載の発明は、複数の反射面を有したミラーをレンズの前面に配置し、このミラーで反射した車外の複数の方向からの光線をレンズで受光して撮像素子に結像させるようにした車載用多方向撮像カメラ装置において、前記ミラーの反射面をそれぞれ 2 段の面部で形成したことを特徴とする車載用多方向撮像カメラ装置を提供する。

【0 0 0 5】また請求項 2 記載の発明は、前記ミラーの反射面の一部に平面部を、残部に曲面部をそれぞれ形成したことを特徴とする車載用多方向撮像カメラ装置を提供する。

【0 0 0 6】また請求項 3 記載の発明は、前記ミラーが左右一對の反射面を有するとともに、該一對の反射面の境界にある稜線部をレンズの前面に配置し、かつ該稜線部の両側に平面部を、残部に曲面部をそれぞれ形成したことを特徴とする車載用多方向撮像カメラ装置を提供する。

【0 0 0 7】また請求項 4 記載の発明は、前記撮像素子を収納したケースを車両の先端に装着するとともに、前記レンズの受光方向を車両の後方に向けて設定したことを特徴とする車載用多方向撮像カメラ装置を提供する。

【0 0 0 8】

【発明の実施の形態】この発明に係る実施の形態を、添付図に基づき説明する。図面中の 1 はケース、2 はカバー、3 はミラー、4 はレンズ、5 はレンズマウント、6 は基板、7 は撮像素子、8 はミラーホルダ、9 は固定板、1 0 はパッキング、1 1，1 2 は防振ゴム、1 3 はフィルタ、1 4 はスペーサおよび 1 5 はサブ基板である。以下、これら各構成について説明する。

【0 0 0 9】まずケース 1 は不透光性の部材で成形したものであり、カバー 2 を組み合わせると所定の収納箱を形成する。該ケース 1 とカバー 2 との接合面にはパッキング 1 0 を装着しており、水密構造を形成している。

【0 0 1 0】またカバー 2 は、左右の窓 2 1，2 2 を除く他の部分が不透光性を有したものである。例えば、透明アクリル樹脂で成形した左右の窓 2 1，2 2 を不透光性の部材にインサート成形して形成するとか、透明アクリル樹脂でカバー 2 を成形したのち左右の窓 2 1，2 2 を除く他の部分に黒色塗装を施して形成する、等の適宜の手段を用いて形成する。

【0 0 1 1】またミラー 3 は、側面形状が略三角形を成したものであり、合成樹脂で成形したのち左右一對の反射面 3 1，3 2 にアルミ蒸着を施して鏡面を形成する。この 2 つの反射面 3 1，3 2 間の境界には稜線部 3 3 が存在している。各反射面 3 1，3 2 は、それぞれ稜

線部33の両側に平面部31N、32Nを形成し、残部に曲面部31W、32Wを形成している。これにより、左側の反射面31の平面部31Nでは、図1及び図4に角度 θ_{LN} で示す車両Bの左方向の範囲が普通の状態に反射され、残りの曲面部31Wでは、角度 θ_{LW} で示す範囲が広角の状態に反射されることと成る。同様に、右側の反射面32の平面部32Nでは、角度 θ_{RN} で示す右方向の範囲が普通の状態に反射され、残りの曲面部32Wでは、角度 θ_{RW} で示す範囲が広角の状態に反射されることと成る。

【0012】またレンズ4は、上記ミラー3の各反射面31、32で反射した光線を集光するものであり、その焦点を後述する撮像素子7の表面に設定している。該レンズ4は、撮像素子7を載置した基板6に対しレンズマウント5を用いて装着する。尚、レンズマウント5内部には可視光線以外の波長の光を遮断するためのフィルタ13と、スペーサ14とが設けてある。このレンズ4の前面には、上記したミラー3の稜線部33を配置する。

【0013】また基板6は、上記レンズ4を支持したレンズマウント5の他にサブ基板15およびターミナル61を装着しており、ケース1の穴1aに挿入したターミナル61によって車室内のAV(Audio Visual)装置(図示せず)と電気的に接続可能に構成している。該基板6とカバー2との間には防振ゴム11、12を装着しており、基板6を弾性的に支持している。

【0014】また撮像素子7は、該素子の表面に結像した光を電気的な撮像信号に変換するための素子であり、例えばCCD(Charge Coupled Device)素子を採用している。

【0015】またミラーホルダ8は、不透光性の部材から成り、仕切板81を一体的に形成している。仕切板81は、2つの反射面31、32間を光学的に遮断して光線が廻り込むことを阻止する為の構成であり、ミラー3の稜線部33とレンズ4との間に設けている。したがって、左側の窓21から入射した光線は左側の反射面31でのみ反射し、右側の反射面32には廻り込まない。同様に右側の窓22から入射した光線は右側の反射面32でのみ反射し、左側の反射面31には廻り込まない。

【0016】このように構成した車載用多方向撮像カメラ装置Aは、車両Bの先端の例えばフロントバンパー部の近くに取り付けると共に、レンズ4の受光方向を車両Bの後方に向けて設定し、前記左側の反射面31を車両Bの左方向に、右側の反射面32を右方向にそれぞれ向けている。このようにレンズ4の受光方向を車両Bの後*

*方に向けて設定した場合、撮像素子7の表面に結像する映像およびAV装置に表示する映像は、図3に例示するように左右反転しない映像、すなわち目視で見たままの映像と成り、視認性が優れている。しかも、反射面31の平面部31N、32Nでは普通の状態に反射され、残りの曲面部31W、32Wでは広角の状態に反射されるので、撮像した映像は、図3に記号LN、RNで示す左映像a及び右映像bの境界線cに近い中央範囲が普通の映像に成り、記号LW、RWで示す両端範囲が広角の映像と成る。したがって、反射面31、32全体が平面である場合に比べて撮像範囲の死角を少なくすることができる。

【0017】ここで、一方の反射面32の曲面部32Wの曲率半径Rを設計するための計算式を、図5を用いて説明する。図5中の記号Rは曲面部32Wの曲率半径、記号Tはミラー3の高さ寸法、記号Lはミラー3の稜線部33からレンズ4の焦点までの距離、記号Wはミラー3の片側の底辺寸法を示している。また記号 θ_0 はレンズ4の画角の $1/2$ の角度、記号 θ_1 はミラー3の取り付け角度、記号 θ_2 は視野限界を図5に記号Dで示す位置(このときの法線を記号Cで示す)から記号D'で示す位置(このときの法線を記号C'で示す)に広げた角度(後方視角)、記号 θ_3 はミラー3の一方の鏡面中心角を示している。

【0018】上記記号R、T、L、W、 θ_0 、 θ_1 、 θ_2 、 θ_3 の関係から、曲面部32Wの曲率半径Rを求める計算式を求めると次のように成る。まず底辺寸法Wと距離L、高さ寸法T及び角度 θ_0 との関係は、 $W = (L + T) \tan \theta_0 \dots \dots \dots$ 式(1)と成る。また角度 θ_1 と高さ寸法T及び底辺寸法Wとの関係は、

$$\theta_1 = \tan^{-1} (T/W) \dots \dots \dots \text{式(2)}$$

と成る。図5に記号Eで示す線は角度 θ_3 の二等分線であるが、この二等分線Eは前記法線Cと平行($E \parallel C$)で有る。

【0019】反射面32の視野限界を角度 θ_2 程広げる場合、図5に示す法線Cもまた角度 θ_2 程傾いて法線C'と成る。この法線Cは、上記したように角度 θ_3 の二等分線Eと平行であり、

$$\theta_2 = \theta_3 / 2 \dots \dots \dots \text{式(3)}$$

の関係が成立する。

【0020】また底辺寸法Wと曲率半径R、角度 θ_3 及び角度 θ_1 との関係は、

$$\begin{aligned} W &= 2 \times R \times \sin(\theta_3 / 2) \times \cos \theta_1 \\ &= 2 \times R \times \sin \theta_2 \times \cos \theta_1 \dots \dots \dots \text{式(4)} \end{aligned}$$

であり、該式(4)から

$$R = W / (2 \times \sin \theta_2 \times \cos \theta_1) \dots \dots \dots \text{式(5)}$$

が求められる。したがって、該式(5)に前記式(1)(2)を代入すると、

$$R = \{ (L + T) \tan \theta_0 \} / \{ 2 \times \sin \theta_2 \times \cos \{ \tan^{-1} \{$$

$$T / (L + T) \tan \theta \} \rangle \dots \dots \dots \text{式 (6)}$$

と成る。曲率半径Rは、この式(6)によって計算することができる。

【0021】

【発明の効果】請求項1記載の発明は、複数の反射面を有したミラーをレンズの前面に配置し、このミラーで反射した車外の複数の方向からの光線をレンズで受光して撮像素子に結像させるようにした車載用多方向撮像カメラ装置において、前記ミラーの反射面をそれぞれ2段の面部で形成したことを特徴とする車載用多方向撮像カメラ装置であるので、車外状況を撮像した場合に撮像範囲の死角が少なく成り、安全確認度合いが向上する効果がある。

【0022】また請求項2記載の発明は、前記ミラーの反射面の一部に平面部を、残部に曲面部をそれぞれ形成したことを特徴とする車載用多方向撮像カメラ装置であるので、前記効果に加えて、撮像素子によって撮像した車外状況が歪みの無い普通映像と、広角映像の両方で確認できる効果がある。

【0023】また請求項3記載の発明は、前記ミラーが左右一対の反射面を有するとともに、該一対の反射面の境界にある稜線部をレンズの前面に配置し、かつ該稜線部の両側に平面部を、残部に曲面部をそれぞれ形成したことを特徴とする車載用多方向撮像カメラ装置であるので、前記効果に加えて、例えば確認重要度の高い道路の中央側が歪みの無い普通映像で確認できるため、他車両との距離を把握し易く、かつ路肩側が広角映像で確認できるため、路肩側を走行して来る二輪車等も把握するこ*

*とができる効果がある。

【0024】また請求項4記載の発明は、前記撮像素子を収納したケースを車両の先端に装着するとともに、前記レンズの受光方向を車両の後方に向けて設定したことを特徴とする車載用多方向撮像カメラ装置であるので、前記効果に加えて、撮像素子の表面に結像する映像およびAV装置に表示する映像が、左右反転しない映像、すなわち目視で見たままの映像と成り、視認性が優れている効果がある。

【図面の簡単な説明】

【図1】この発明の実施の形態を示す要部を示す断面図である。

【図2】図1に示すものの分解斜視図である。

【図3】図1に示すもので撮像した映像の説明図である。

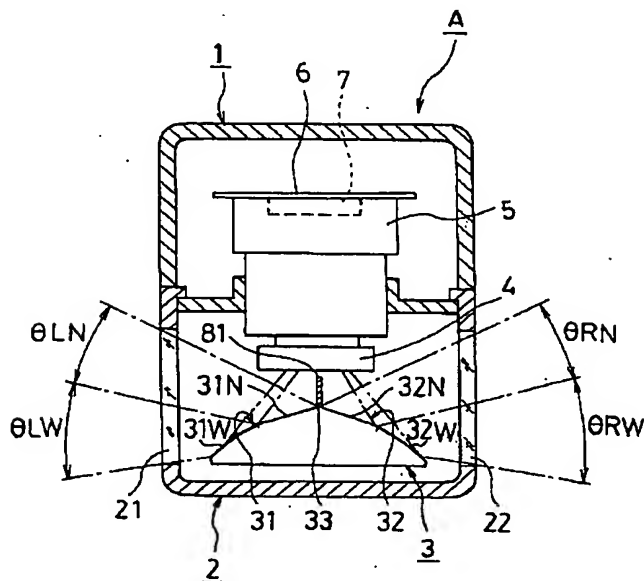
【図4】図1に示す車載用多方向撮像カメラ装置Aを搭載した車両Bの上面図である。

【図5】図1に示すミラーを設計する計算式を説明するための説明図である。

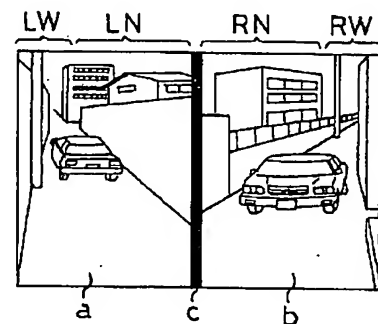
【符号の説明】

- 1 ケース
- 2 カバー
- 3 ミラー
- 31, 32 反射面
- 33 稜線部
- 4 レンズ
- 7 撮像素子

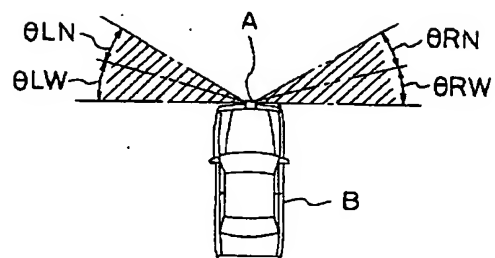
【図1】



【図3】



【図 4】



【図 5】

